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**OCR**  
**A Level**  
Computer  
Science  
H446 – Paper 2

2

**Selection**

Unit 11  
Programming  
techniques



**PG ONLINE**

# Objectives

- Use relational operators
- Use Boolean operations AND, OR, NOT
- Use the switch/case statement for selection
- Use nested selection statements

# if .. then .. endif

- Program flow is controlled by evaluating a Boolean condition
- A Boolean condition evaluates to True or False
- If the condition is true then one or more statements are executed
  - if condition x is True then
  - execute statements 1, 2, 3...
  - endif
- If condition x is not true, statements 1, 2, 3.. are skipped and control passes to the next statement



# Relational operators

> greater than

< less than

=> greater than or equal to

=< less than or equal to

== equal to (= in some languages)

!= not equal to (<> in some languages)

*Operators vary according to programming languages*



# Complete the table:

X	Y	condition	True or False?
5	4	$X > Y$	
4	4	$X \leq Y$	
10	11	$X \geq Y$	
10	10	$X \geq Y$	
8	9	$X \neq Y$	



# Complete the table:

X	Y	condition	True or False?
5	4	$X > Y$	True
4	4	$X \leq Y$	True
10	11	$X \geq Y$	False
10	10	$X \geq Y$	True
8	9	$X \neq Y$	True

# if.. then.. endif

- In the example below print ("y is less than x") would not be executed as the condition  $y < x$  is not true

```
x = 3
y = 4
if x < y then
    print("x is less than y")
endif
```

```
if y < x then
    print("y is less than x")
endif
```



# Complex Boolean expressions

- Boolean expressions can include AND, OR and NOT
- For example:

if (grade < 0) OR (grade > 100) then ...

Operator	Description
AND	Returns TRUE if both conditions are true
OR	Returns TRUE if either of the conditions is true
NOT	A TRUE expression becomes FALSE and vice versa



# Examples

```
if age > 12 AND height > 3 then  
    print("You can ride the roller  
coaster")  
endif
```

```
if age <13 OR age > 19 then  
    print("You are not eligible for teen  
discount")  
endif
```

```
if NOT ((age > 12) AND (height > 3)) then  
    print("You cannot ride the roller  
coaster")  
endif
```



# True or false?

- Which of the following are true?

X	Y	Z	Condition	True or False?
3	4	5	$X > Y \text{ AND } Z > Y$	
3	4	5	$X + 3 > Y \text{ OR } X - 2 \leq Y$	
4	5	6	$(X \leq Y \text{ AND } Y == Z) \text{ OR } (Z > X)$	
4	5	6	$(X \leq Y) \text{ AND } (Y == Z \text{ OR } Z < X)$	
3	9	11	$Y \bmod X == 0 \text{ AND } Z \bmod X == 2$	
3	9	11	$\text{NOT } ((Z > X) \text{ AND } (Z > Y))$	



# Boolean expressions

- Answers

X	Y	Z	Condition	True or False?
3	4	5	$X > Y \text{ AND } Z > Y$	FALSE
3	4	5	$X + 3 > Y \text{ OR } X - 2 \leq Y$	TRUE
4	5	6	$(X \leq Y \text{ AND } Y == Z) \text{ OR } (Z > X)$	TRUE
4	5	6	$(X \leq Y) \text{ AND } (Y == Z \text{ OR } Z < X)$	FALSE
3	9	11	$Y \bmod X == 0 \text{ AND } Z \bmod X == 2$	TRUE
3	9	11	$\text{NOT } ((Z > X) \text{ AND } (Z > Y))$	FALSE



# if .. then .. else .. endif

- Often, alternative statements need to be executed if the given condition is not met
- The **if .. then .. else .. endif** statement provides this option

```
if condition c then
    statements a, b, c,..
else
    statements x, y, z,..
endif
```



# Example

- Which statement would be executed in each of the statements below?
  - $X = 5, Y = 6, A = 9, B = 10$

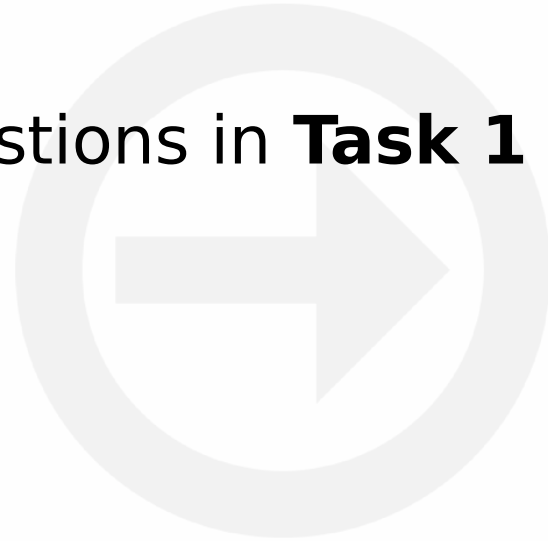
```
if X > Y OR A <= B
then
    print("Option 1")
else
    print("Option 2")
endif
```

```
if X > Y AND A <= B then
    print("Option 1")
else
    print("Option 2")
endif
```



# Worksheet 2

- Now work through the questions in **Task 1** on the worksheet





# if .. then .. elseif .. else .. endif

- Use multiple if ..then.. else if statements to evaluate more than one condition
- What would the output be for each of the following values?
  - age = 11, age = 12 and age = 13

```
if age < 12 then
    print("Age is less than 12")
elseif age = 12 then
    print("Age is 12")
else
    print("Age is greater than 12")
endif
```



# switch/case .. endswitch

- A switch/case statement is the logical equivalent of the if.. then.. else .. endif statement
  - It is used to make it easier to code multiple condition checks
  - Some languages (e.g. Python) do not have a switch/case statement

switch choice:

```
    case a:      print("You chose  
a")  
    case b:      print("You chose  
b")  
    case c:      print ("You chose  
c")  
    default:  
                  print("Invalid  
choice")
```



# Sample problem

- Suppose you need to calculate grades from exam marks and print out the grade for each student
  - What grade boundaries would you select?
  - What input would you need?
  - What conditions would you evaluate?
  - What output statements would you need?



# Worksheet 2

- Now work through **Task 2** on the worksheet



# Nested if

- In the nested if statement, the second condition is only checked if the first condition is true:

```
if x then
    if y then
        print ("A")
    else
        print ("B")
    endif
else
    print ("C")
endif
print ("D")
```



# Nested if

- What will the output be if age is (i) 11 (ii) 12 (iii) 13

```
if age > 11 then
    if age > 12 then
        print ("Age Group 1")
    else
        print ("Age Group 2")
    endif
else
    print ("Age Group 3")
endif
print ("This is the end of the
program")
```





# Nested IF vs AND operator

- Compare these algorithms. What output would each produce with the following input:

(i) age 10, height 1m (ii) age 10, height .95m (iii) age 9, height 1m

```
if age >= 10 AND height >= 1
then
    print("You can ride the
    rollercoaster.")
else if age>=10 AND height<1
then
    print("You are too short
    to ride.")
else if age < 10 then
    print("You are too young
    to ride.")
endif
```

```
if age >= 10 then
    if height >= 1 then
        print("You can ride
        the rollercoaster.")
    else
        print("You are too
        short to ride.")
    else
        print("You are too young
        to ride.")
endif
```



# Worksheet 2

- Now work through **Task 3** on the worksheet



# Plenary

- **if .. then .. else** statements can control program flow
  - relational operators can be used to compare values within the expression
  - Boolean operators **AND, OR** can be used to link multiple expressions
  - **elseif** (elif in Python) can be used to evaluate multiple expressions
  - **switch... endswitch** can be used to evaluate multiple expressions

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